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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/069,945	09/19/2002	Petrus Basson	P.19477/MAJR	4581

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Jennifer P Yancy
Jones Tullar & Cooper
Eads Station
PO Box 2266
Arlington, VA 22202

EXAMINER	
WILKINS III, HARRY D	

ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 02/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/069,945	BASSON ET AL.
	Examiner	Art Unit
	Harry D. Wilkins, III	1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 December 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *50-65 and 67-81* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *50-65 and 67-81* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Status

1. The previous rejection grounds relying on the disclosure of Whellock et al have been withdrawn. However, new grounds of rejection are presented with respect to newly found prior art reference Vahldieck. In addition, the teachings of Brierley are incorporated into the rejection of claim 50.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 71-73 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: subjecting the slurry to a temperature in excess of 45°C. Claim 71 requires a slurry temperature not in excess of 45°C.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 50, 67-70, and 74-81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Emmett, Jr et al (US 5,007,620) in view of Brierley (US 5,332,559),

McWhirter et al (US 6,299,776), Eppstein et al (US 4,680,267), and Vahldieck (US 3,926,794).

Emmett, Jr et al teach (see abstract) a method of recovering a metal (zinc, see col. 1, lines 61-64) from a metal bearing sulfide mineral slurry, including the steps of subjecting the slurry in a reactor to a bioleaching process, supplying a feed gas containing oxygen (air, see fig. 22, which contains 21% oxygen), and recovering metal from the bioleach residue (see col. 1, lines 38-60).

Thus, Emmett, Jr. et al do not teach (1) using thermophilic bacteria for temperatures over 45°C, (2) the step of controlling the dissolved oxygen concentration in the slurry to a desired level by controlling at least one of the oxygen content of the feed gas, the supply of feed gas or the rate of feed of slurry or (3) the feed gas containing oxygen contains at least 85% oxygen.

Emmett, Jr. et al teach the mesophilic bacteria were preferred, but does not exclude the use of thermophilic bacteria.

Brierley et al teach (see abstract and col. 21, line 60 to col. 22, line 13) using various different bacterial microorganisms for the decomposition of metal sulfide ores. Brierley et al teach using thermophilic bacteria (used at temperatures above 50°C) *Sulfobacillus thermosulfidooxidans* or *Sulfolobus acidocaldarius* species of bacterium.

Therefore, it would have been obvious to one of ordinary skill in the art to have substituted the thermophilic microorganisms of Brierley et al for the mesophilic microorganisms of Emmett, Jr. et al because the thermophilic bacteria have the

advantage of being more heat resistant to withstand the exothermic bioleach process (see paragraph spanning cols. 22 and 23).

McWhirter et al teach (see col. 1, line 26 to col. 2, line 19) that the dissolved oxygen concentration in bioleaching (biochemical oxidation) controls the rate at which sulfides were oxidized to sulfates by microorganisms. Thus, the dissolved oxygen concentration was recognized in the prior art as a result effective variable.

Eppstein et al teach (see abstract) control means for adjusting the dissolved oxygen concentration in a bioreactor, which is measured by an oxygen sensor, that controls the oxygen content of the feed gas.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the controlling step of Eppstein et al to the method of Emmett, Jr et al because McWhirter et al teach that dissolved oxygen controls the rate of the reaction and the controlling step of Eppstein et al can control the dissolved oxygen level in a bioreactor to a desired high amount to facilitate the reaction.

Vahldieck teaches (see col. 1, line 9 to col. 4, line 29) that in aerobic thermophilic biological oxidation reactions, difficulty arose in achieving sufficient dissolved oxygen concentration due to lowered Henry's Law constant and reduced partial pressure of oxygen in the gas phase (both of which equate to lowered effective oxygen concentration in Applicant's formula (1)). Vahldieck suggests using high concentration oxygen gas, such as pure oxygen to increase the mass transfer rate of oxygen into the high temperature slurry.

Therefore, it would have been obvious to one of ordinary skill in the art to have used pure oxygen, or at least enhanced concentration oxygen (at least 85%), as the feed gas in the process of Emmett, Jr. et al and Brierley et al because Vahldieck teach that increasing the oxygen concentration improves the rate of oxygen dissolution.

Regarding the actual concentration of dissolved oxygen in the slurry, it would have been within the expected skill of a routineer in the art to have optimized the concentration of oxygen in the slurry in order to maximize the reaction rate. Emmett, Jr. et al describe (see figs. 24 and 28) oxygen concentrations ranging from 1 to 4 mg/L (1.0×10^{-3} kg/m^3 to 4.0×10^{-3} kg/m^{-3}). Brierley et al teach (see col. 24, lines 21-24) using a dissolved oxygen concentration of 0.5-2 mg/L. Thus, one of ordinary skill in the art would have controlled the dissolved oxygen concentration to a comparable value.

Regarding claims 67 and 68, Emmett, Jr. et al do not expressly teach controlling the carbon content of the slurry. However, as the carbon content directly relies on the carbon dioxide present in the slurry, and the carbon dioxide affects the bioleach process, it would have been obvious to one of ordinary skill in the art to have controlled the amount of carbon in the slurry. Means similar to the oxygen control of Eppstein et al would have been utilized. It would have been within the expected skill of a routineer in the art to have found the optimum amount of carbon dioxide in the feed gas for producing the best bioleaching results.

Regarding claims 69, 70 and 74-79, Brierley et al teach (see abstract and col. 21, line 60 to col. 22, line 13) using various different bacterial microorganisms for the decomposition of metal sulfide ores. Brierley et al teach using *Sulfobacillus*

thermosulfidooxidans or *Sulfolobus acidocaldarius* species of bacterium. These bacteria were utilized at thermophilic temperatures, i.e.-above 55°C.

Regarding claim 80, Emmett, Jr. et al teach (see fig. 22) a plant for recovering zinc that includes a reactor vessel (232), a source which feeds the slurry to the vessel, an oxygen source (air compressor) supplying gas to the slurry, and a recovery system to recover zinc from the bioleach residue. Thus, Emmett, Jr. et al fail to teach the device that measures the dissolved oxygen concentration and the control mechanism as claimed.

McWhirter et al teach (see col. 1, line 26 to col. 2, line 19) that the dissolved oxygen concentration in bioleaching (biochemical oxidation) controls the rate at which sulfides were oxidized to sulfates by microorganisms.

Eppstein et al teach (see abstract) control means for adjusting the dissolved oxygen concentration in a bioreactor, which is measured by an oxygen sensor, that controls the oxygen content of the feed gas.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the oxygen sensor and control means of Eppstein et al to the plant of Emmett, Jr et al because McWhirter et al teach that dissolved oxygen controls the rate of the reaction and the oxygen sensor and control means of Eppstein et al can control the dissolved oxygen level in a bioreactor to a desired high amount to facilitate the reaction.

It would have been obvious to one of ordinary skill in the art to have fed high concentration oxygen gas to the reactor as taught by Vahldieck (see above) in order to improve the rate of oxygen dissolution.

Regarding claim 81, regarding the limitations that the reactor vessel is operated at temperature in excess of 60°C, the above limitations are not further limiting on the apparatus claim because the above limitation deals with the manner or method of use of the claimed apparatus. It has been well settled that the manner or method of use of an apparatus cannot be relied upon to further limit claims to the apparatus itself. See In re Casey, 152 USPQ 235, and MPEP 2114. However, even if the limitation were given patentable weight, Brierley et al suggest using thermophilic bacteria at temperatures exceeding 55°C.

6. Claims 51-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Emmett, Jr et al (US 5,007,620) in view of Brierley et al (US 5,332,559), McWhirter et al (US 6,299,776), Eppstein et al (US 4,680,267) and Vahldieck (US 3,926,794) as applied to claims 50, 67-81 above, and further in view of Steemson et al (WO 94/28184).

Regarding claims 51-53, Emmett, Jr et al do not teach the steps of removing copper or iron from the bioleach residue before recovering zinc. However, Steemson et al teach (see fig. 1) a similar bioleach process that includes removing copper and iron from the bioleach residue before recovering zinc. It would have been obvious to one of ordinary skill in the art to have removed copper and iron from the bioleach residue in order to ensure a purer zinc product. Steemson et al teach (see fig. 1) removing the iron by adding limestone.

Regarding claims 54, 56, 57 and 58, Emmett, Jr et al do not teach the steps of subjecting the bioleach residue to a recovery process that includes zinc solvent extraction and zinc electrowinning to produce zinc cathodes. However, Steemson et al

teach (see fig. 1) a similar bioleach process that includes a recovery process that includes zinc solvent extraction and zinc electrowinning to produce zinc cathodes. It would have been obvious to one of ordinary skill in the art to have performed the recovery process of Steemson et al in order to ensure a pure zinc product. Steemson et al also teach recycling the zinc raffinate to the bioleaching process. Steemson et al also teach including neutralizing acid (lime/limestone) in the raffinate to produce gypsum. This would inherently also produce CO_2 and precipitate co-leached iron.

Regarding claim 55, it would have been obvious to one of ordinary skill in the art to have recycled the oxygen generated during electrowinning to the bioleach reactor in order to avoid wasting pure oxygen to the atmosphere.

Regarding claim 59, it would have been obvious to one of ordinary skill in the art to have recycled the carbon dioxide generated during neutralizing to the bioleach reactor in order to avoid wasting pure carbon dioxide to the atmosphere.

Regarding claims 60, 61, 63 and 64, Emmett, Jr et al do not teach the steps of subjecting the bioleach residue to an electrowinning step to produce zinc cathodes. However, Steemson et al teach (see fig. 1) a similar bioleach process that includes an electrowinning step to produce zinc cathodes. It would have been obvious to one of ordinary skill in the art to have performed the electrowinning step of Steemson et al in order to ensure a pure zinc product. Steemson et al also teach recycling the spent electrolyte to a zinc oxide leach stage. Steemson et al also teach neutralizing the electrolyte with limestone to produce gypsum. This would inherently also produce CO_2 and precipitate co-leached iron.

Regarding claim 62, it would have been obvious to one of ordinary skill in the art to have recycled the oxygen generated during electrowinning to the bioleach reactor in order to avoid wasting pure oxygen to the atmosphere.

Regarding claim 65, it would have been obvious to one of ordinary skill in the art to have recycled the carbon dioxide generated during neutralizing to the bioleach reactor in order to avoid wasting pure carbon dioxide to the atmosphere.

Response to Arguments

7. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. However, the Examiner would like to point out that the prior art (Vahldieck) did recognize the difficulties associated with dissolving oxygen into a bioreaction slurry at thermophilic conditions (i.e.-above 45°C). Thus, Applicant's remarks regarding this problem are not found persuasive.

8. Additionally, with respect to Vahldieck being related to a waste treatment method and not bioleaching of a sulfide ore, the teachings of Vahldieck are considered to be extremely pertinent to the problems associated with using thermophilic temperatures in biological oxidation reactors, particularly the problem of ensuring adequate oxygen dissolution rate.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Harry D. Wilkins, III

Harry D Wilkins, III
Examiner
Art Unit 1742

hdw